Air Quality Effects Analysis
for
Permit to Construct

Applicant:

Meridian Energy Group, Inc.
2062 Business Center Drive, Suite 115
Irvine, CA 92612

Source Location:

Davis Refinery
Section 1 SW¼ & Section 2 SE¼, Township 139N, Range 100W
Approximately 2 miles west of Belfield (37th Street)
Billings County, North Dakota

Introduction:

On October 17, 2016, the North Dakota Department of Health (Department) received a permit application for a new petroleum refinery; Davis Refinery (facility) to be located near Belfield, North Dakota. On April 5, 2017, the Department received an amended permit application for construction of the Davis Refinery. The amended application included one significant process change that reduced the potential emissions from the facility, utilization of a hydrocracking processing unit in lieu of a fluidized catalytic cracking unit. The other changes were minor in nature (i.e. heater and equipment size updates) and did not greatly affect the emissions profile at the facility. The Department had numerous questions and comments for Meridian upon receipt of the amended application. On May 15, 2017, the Department submitted a list of questions to Meridian regarding the emission rates contained in the application. In June 2017, Meridian submitted the requested information which contained the basis of the potential to emit (PTE) calculations provided in the April permit application. Since then, the Department has worked through the specifics of the application and associated supporting documentation with Meridian. Based on the Department's review, contained in this document, the Department proceeded to draft a Permit to Construct (Attachment 1) for the construction and initial operation of the facility.

The facility is planned to be constructed in two phases; however, for air quality permitting purposes the impact of the entire planned project was taken into consideration. Upon completion of Phase 1, the Davis Refinery will have the capacity to process an annual average of approximately 27,500 barrels (bbl) per day of crude oil. Upon completion of Phase 2, the capacity will increase to 55,000 bbl per day of crude oil. The crude oil feedstock is expected to

be generated from the North Dakota Bakken formation.

The primary products of the refinery will be gasoline and diesel fuel, which will be transported via truck from the facility. Other products produced at the refinery will be jet fuel, fuel oil, and liquefied petroleum gas (LPG), these products will also be transported from the facility via truck.

All fuel gas combustion devices (FGCD) at the facility will be fired on refinery fuel gas or pipeline quality natural gas. A plot plan and process flow diagram are attached to this analysis.

The process units, emission units, emission points, and pollution controls at the facility are listed in the following table:

Process Unit	**Emission Unit Description**	**Unit (EU)**	**Point (EP)**	**Equipment or Design Features**	
Unit (ADU) Crude desalting and distillation unit with an estimated capacity of 2 x 27,500 bbl/day (55,000 bbl/day total)	equipment			Detection and Repair (ELDAR) Program Vapor Recovery Unit (VRU) system, excess emissions to flare (EU10), Design Requirements of New Source Performance Standards, Subpart NNN (NSPS NNN)	
	ADU Feed Heater #1 rated at 82.13 MMbtu/hr			Practices (BCP), Ultra Low-NO_X Burner (ULNB), and Selective Catalytic Reduction (SCR)	
	ADU Feed Heater #2 rated at 82.13 MMbtu/hr				
	ADU sewers			of New Source Performance Standards, Subpart QQQ (NSPS QQQ)	
(VDU) ADU tower bottoms distillation unit with an estimated capacity of 16,800 bbl/day	equipment			NSPS NNN	
	VDU Feed Heater rated at 75.00 MMbtu/hr				
	VDU sewers				
Unit (NHT) with an estimated capacity of 18,205 bbl/day	equipment			NSPS NNN	

	NHT Feed Heater rated at 8.60 MMbtu/hr				
	NHT Stabilizer Reboiler rated at 9.30 MMbtu/hr				
	NHT Splitter Reboiler rated at 17.90 MMbtu/hr				
	NHT sewers				
(CRU) with an estimated capacity of 16,128 bbl/day Hydrogen (H_2) production from CRU is between 4-19 MMscf/day	equipment			NSPS NNN	
	CRU Reactor #1 Heater rated at 45.63 MMbtu/hr				
	CRU Reactor #2 Heater rated at 45.63 MMbtu/hr			BCP, ULNB, SCR	
	CRU Reactor #3 Heater rated at 45.63 MMbtu/hr			BCP, ULNB, SCR	
	CRU Stabilizer Reboiler rated at 5.70 MMbtu/hr				
	CRU Regenerator Vent				
	CRU sewers				
Unit (DHT) with an estimated capacity of 19,850 bbl/day	equipment			NSPS NNN	
	DHT Feed Heater rated at 19.50 MMbtu/hr				
	DHT Splitter Reboiler rated at 27.30 MMbtu/hr				
	DHT sewers				
(HYK) with an estimated capacity of 14,380 bbl/day	equipment			NSPS NNN	
	HYK Reactor Heater rated at 37.16 MMtbu/hr				

	HYK Fractionator Heater rated at 40.34 MMbtu/hr				
	HYK sewers				
(SRU) with an estimated capacity of 11.5 tpd sulfur production	equipment				
	Thermal Oxidizer with a rated capacity of 1.58 MMbtu/hr				
	SRU sewers				
	Medium Pressure Steam Boiler #1 rated at 11.68 MMbtu/hr				
	Medium Pressure Steam Boiler #2 rated at 11.68 MMbtu/hr			BCP, ULNB	
	Medium Pressure Steam Boiler #3 rated at 11.68 MMbtu/hr			BCP, ULNB	
	Medium Pressure Steam Boiler #4 rated at 11.68 MMbtu/hr			BCP, ULNB	
	High Pressure Steam Boiler #1 rated at 22.00 MMbtu/hr				
	High Pressure Steam Boiler #2 rated at 22.00 MMbtu/hr				
	High Pressure Steam Boiler #3 rated at 22.00 MMbtu/hr				
	Storage Tank Farm			Table	
	Oil Movements				

Flare System	hydrocarbon (HC) operating flare rated to handle up to 24.4 MMscf/day (including purge and fuel gas blowdown)			control, Smokeless Operation	
	Acid gas flare rated to handle up to 15.8 MMscf/day			compliant, Smokeless Operation	
	HC secondary flare #1 rated to handle up to 74.6 MMscf/day			control, Smokeless Operation	
	HC secondary flare #2 rated to handle up to 88.8 MMscf/day			control, Smokeless Operation	
System					
	Truck loading rack VRU system			VRU, MACT BBBBBB (6B)	
Plant (WWTP)	from Benzene Waste Operators NESHAP (BWON) compliant plant			NESHAP FF	
five cell induced draft counter flow system with a water circulation rate of 2,500 gal/min for each cell.				(0.001% maximum drift) inherent to design	
	CT cell #2		13B		1
	CT cell #3		13C		2
	CT cell #4		13D		2
	CT cell #5		13E		2
	Power Generators each rated at 4,700 BHP	14B 14C	14B 14C		
	Three Back-up Diesel Engine Firewater Pumps each rated at 600 BHP	15B 15C	15B 15C		

[A] Common flue stack.

[B] Merichem LO-CAT® technology, reduction control.

[C] Common flue stack. Under normal operations, during Phase 1, two will be in service and one on stand-by, during Phase 2, three will be in service and one on stand-by.

D Under normal operations, two will be in service and one on stand-by.

E Under normal operations, the acid gas flow is routed to the SRU.

F Under normal operations, during Phase 1, one will be in service and one on stand-by. During Phase 2, four will be in service and one on stand-by.

G The engines shall be certified to emissions standards as outlined under 40 CFR 60, Subpart IIII. The engines shall be manufactured and installed with the appropriate control equipment to meet these emissions standards.

Storage Tanks Table:

Storage Area		**Capacity (bbl)**		
				(IFR), Submerged Fill Pipe (SFP)
	302			
Products			naphtha	
	313		and Diesel)	
	327			
	328			
	323		Oil	
	307			
	331		naphtha	
	332		naphtha	
	P302 [A]			
	P303 [A]			
	P304 [A]			
	P305 [A]			
	P306 [A]			
	308			
	309			
	311			
	312			
	315		(ULSD)	

	316			
	324			

[A] Insignificant emissions units.

Allowable/Expected Emissions:
Potential emissions from the facility are shown below:

Unit		Criteria Pollutants*							Total HAP
	CO	NO_X	SO_2	VOC	PM	PM_{10}	$PM_{2.5}$	FPM	CPM	
Leaks (fugitive VOCs)	-	-	-	12.73	-	-	-	-	-	1.14
Tanks	-	-	-	7.43	-	-	-	-	-	2.30
Process Heaters and Boilers	76.16	34.51	7.50	14.67	10.88	10.88	10.88	2.72	8.16	1.35
Emergency Generating units**	4.37	10.32	-	0.56	0.54	0.54	0.54	0.45	0.07	0.04
Catalytic Reforming Unit	-	-	-	0.71	-	-	-	-	-	0.07
Sulfur Recovery Plant	2.36	0.52	0.22	1.65	-	-	-	-	-	-
Blowdown System***	0.83	3.66	5.20	0.15	0.01	0.01	0.01	0.01	-	-
Flares (pilot gas)	0.25	0.27	0.01	0.05	-	-	-	-	-	-
Wastewater	-	-	-	14.54	-	-	-	-	-	0.72
Cooling Towers	-	-	-	0.39	2.07	2.07	-	-	-	-
Truck Product Loading	-	-	-	5.34	-	-	-	-	-	0.53
Total Ton per Year	**79.60**	**38.96**	**12.93**	**57.66**	**13.00**	**13.00**	**10.89**	**2.73**	**8.16**	**6.12**

* Pollutants are abbreviated as follows:
FPM: filterable particulate matter
CPM: condensable particulate matter
PM: particulate matter
PM_{10}: particulate matter under 10 microns
$PM_{2.5}$: particulate matter under 2.5 microns
SO_2: sulfur dioxide
NO_X: nitrogen oxides
VOC: volatile organic compounds
CO: carbon monoxide
HAPs: hazardous air pollutants as defined in Section 112(b) of the Clean Air Act Amendments of 1990

** Calculations based on 100 hours of operation annually, not included in facility total emissions.

*** Flare system equipped with flare gas recovery during normal operation, process blowdown estimated at 168 hours/year, included in facility total emissions.

Total Annual Emissions

Pollutant	Point Source Emissions (tons/year)	Fugitive Emissions (tons/year)	Total Emissions (tons/year)	Major Source Emission Rates (tons/year)
PM	13.0	-	13.0	100
PM_{10}	13.0	-	13.0	100
$PM_{2.5}$	10.9	-	10.9	100
SO_2	12.9	-	12.9	100
NO_X	39.0	-	39.0	100
VOC	38.0	20.2	58.2	100
CO	80.0	-	80.0	100
HAPs*	2.7	3.5	6.2	25
Hexane**	1.3	1.1	2.4	10

* HAPs are not regulated under the New Source Review (NSR) program. The facility is an area source of HAPs since the potential to emit is less than the thresholds of 10 tpy for each HAP and 25 tpy for total HAPs.

** Hexane is the largest single HAP emitted from the facility.

Carbon monoxide emissions discussion

Carbon monoxide (CO) from the various process heaters and boilers identified in the attached Draft PTC have a higher emission factor (EF) during Phase 1 of the project (actual expected emissions are lower). The higher EF is needed because all of the heaters and boilers are designed for operation at full capacity (55,000 bbl/day); and during Phase 1 operation, the heaters and boilers identified in the Draft PTC will operate below design capacity. During Phase 2, all heaters and boilers will operate at or near design capacity, which results in lower emissions on a lb/MMbtu basis. Operating the units installed during Phase 1 below design capacity (~70% of design) results in a slightly higher CO EF (0.038 lb/MMbtu vs 0.028 lb/MMbtu). Given the number of heaters and boilers installed and operating during Phase 1, the potential CO emissions from these units is approximately 47 tons/year (calculated at 100% design capacity using the higher EF). Ultimately, the EF (lb/MMbtu) is larger, but the mass emission rate (lb/hr or tpy) is lower. The calculations for CO emissions from process heaters and boilers for Phase 1 and Phase 2 are broken out below:

Phase 1

Design capacity of Phase 1 heaters and boilers operating at reduced rates (higher EF) = 197.90 MMbtu/hr
CO EF for Phase 1 units identified in PTC = 0.038 lb/MMbtu

Design capacity of Phase 1 heaters and boilers operating at capacity = 117.17 MMbtu/hr
CO EF for Phase 1 units operating at design capacity = 0.028 MMbtu/hr

Phase 2

Design capacity of Phase 2 heaters and boilers = 621 MMbtu/hr
CO EF for Phase 2 units = 0.028 lb/MMbtu

Note: For perspective on the magnitude of the CO EF change from Phase 1 to Phase 2, the USEPA AP-42 Chapter 1.4 Table 1.4-1 EF for natural gas combustion is 0.082 lb/MMbtu (2.2 times greater than 0.038 lb/MMbtu and 2.9 times greater than 0.028 lb/MMbtu).

Rules Analysis
Potentially Applicable Rules and Expected Compliance Status

A. Chapter 33-15-01 - General Provisions

Multiple topics are included in the General Provisions chapter, these include: entry onto premises - authority, variances, circumvention, severability, land use plans and zoning regulations, measurement of air contaminants, shutdown and malfunction of an installation - requirements for notification, time schedule for compliance, prohibition of air pollution, confidentiality of records, enforcement, and compliance certifications.

Based on the review of the information provided, the facility will comply with all applicable sections of this rule.

B. Chapter 33-15-02 - Ambient Air Quality Standards

The facility must comply with the North Dakota and Federal Ambient Air Quality Standards. In addition to these standards, compliance with the Policy for the Control of Hazardous Air Pollutant Emissions in North Dakota (Air Toxics Policy) is required.

Emissions of all criteria air pollutants are below prevention of significant deterioration (PSD) thresholds, emissions of NO_X and SO_2 will be less than 40 tons/year, and PM_{10} is below 15 tons/year; by the attached October 6, 2014 Department memorandum, modeling is not required to demonstrate compliance with the ambient air quality standards for NO_2, SO_2 and PM_{10}. For a typical source with these expected emissions and proposed stack heights, compliance with the ambient air quality standards would be expected. However, given the location of the facility (near the South Unit of the Theodore Roosevelt National Park, a Class I area) and public interest on the project; the Department required air dispersion modeling to be completed and submitted with the Permit to Construct application to demonstrate that the facility is not expected to cause or contribute to an exceedance of the Ambient Air Quality Standards (AAQS). The modeling results indicate that the facility emissions will not exceed the applicable significant impact levels (SILs) and therefore are not expected to cause or contribute to an exceedance of the AAQS or PSD increments. The Department reviewed the results and ran an independent analysis of the submitted results, which is included in the Air Quality Impacts Analysis (Attachment 3).

Additionally, an analysis of air toxics emissions included with the application demonstrates that air toxics concentrations in the ambient air are expected to be below the applicable guideline concentrations and that the maximum individual carcinogenic risk (MICR) associated with emissions from the facility is expected to be less than the acceptable value of 1 in 100,000 established by the Department's Air Toxics Policy. The facility modeled the MICR to be 6.46×10^{-7} (approximately 15 times lower than the applicable value of 1×10^{-5}) and the Hazards Index (HI) to be 0.004 (approximately 247 times lower than the acceptable level of 1.0).

Based upon the above, the facility is expected to comply with the ambient air quality standards and the Air Toxics Policy.

C. Chapter 33-15-03 - Restriction of Emission of Visible Air Contaminants

This chapter requires all non-flare sources (fuel gas combustion units) to comply with an opacity limit of 20% except for one six-minute period per hour when 40% opacity is permissible. Since each fuel gas combustion unit will be fired on either refinery fuel gas or natural gas (gaseous fuel) using state-of-the-art burner technology, the units are expected to operate well below the 20% limit stated in the rule. Given the low levels of the visibility impairing air pollutants, such as NO_X, SO_2, and $PM_{2.5}$, the Department is imposing a stricter opacity limit than required by rule. The facility will be subject to a limit of 5% except for one six-minute period per hour when 10% opacity is permissible. For purposes of opacity compliance monitoring after the initial PM emissions test, burning of gaseous fuel shall be considered credible evidence of compliance with any applicable opacity limit. However, results from tests conducted in accordance with the test methods in 40 CFR 60 will take precedence over burning of gaseous fuel for evidence of compliance or noncompliance with any applicable opacity limit in the event of enforcement action. Based on Department experience with sources operating similar emission units, the facility is expected to comply with these limits.

Emissions from the emergency diesel fuel-fired generator and fire pump engine are expected to be well below the 20% opacity standard (see Chapter 33-15-08).

This chapter also requires the refinery flare system to comply with an opacity limit of 20% except for one six-minute period per hour when 60% opacity is permissible. However, since the flare system is also subject to the general provisions under 40 CFR 60, Subpart A it will be required to operate with no visible emissions. Specifically, §60.18(c) states "Flares shall be operated with no visible emissions except for periods not to exceed a total of five minutes during any two consecutive hours. Reference Method 22 of 40 CFR 60, Appendix A shall be used to determine compliance with this visible emissions provision." Based on Department experience with sources operating similar emission units, the facility is expected to comply with this chapter and §60.18(c).

D. Chapter 33-15-04 - Open Burning Restrictions

No person may dispose of refuse and other combustible material by open burning, or cause, allow, or permit open burning of refuse and other combustible material, except as provided for in section 33-15-04-02 or 33-15-10-02, and no person may conduct, cause, or permit the conduct of a salvage operation by open burning.

The facility will not conduct open burning on the property.

E. Chapter 33-15-05 - Emissions of Particulate Matter Restricted

This chapter establishes particulate matter emission limits for industrial process equipment and applies to any operation, process, or activity from which particulate matter is emitted except the burning of fuel for indirect heating in which the products of combustion do not come into direct contact with process materials, the burning of refuse, and the processing of salvable material by burning.

Since the fuel burning equipment used for indirect heating is fired on gaseous fuels, the particulate matter limits in this chapter do not apply. It should be noted that combustion of gaseous fuels in the units is expected to result in extremely low particulate matter emissions that are well below the allowable levels established by this chapter.

F. Chapter 33-15-06 - Emissions of Sulfur Compounds Restricted

This chapter applies to any installation in which fuel is burned and the SO_2 emissions are substantially due to the sulfur content of the fuel; and in which the fuel is burned primarily to produce heat. This chapter is not applicable to installations which are subject to an SO_2 emission limit under Chapter 33-15-12, Standards for Performance for New Stationary Sources, or installations which burn pipeline quality natural gas.

The process heaters, boilers, and flare have SO_2 emission limits at or lower than the 40 CFR 60, Subpart Ja standard and are therefore not subject to this chapter. It should be noted that, although the sources are not subject to this chapter, SO_2 emissions from the units are low (total potential SO_2 emissions from the facility are less than 15 tons/year).

G. Chapter 33-15-07 - Control of Organic Compounds Emissions

This chapter establishes requirements for organic compound facilities and the disposal of organic compounds. The refinery wastewater system will be subject to the requirements of 40 CFR 60, Subpart QQQ. Tanks of 1,000 gallons (~24 bbl) and larger shall be: equipped with a submerged fill pipe during filling operations, a pressure tank, or fitted with a vapor recovery system (i.e. Vapor Recovery Unit (VRU)). Fugitive volatile organic compounds (VOCs) from the refinery will be controlled through implementation of an enhanced leak detection and repair (ELDAR) program, equivalent to 40 CFR 63, Subpart H with equipment leak thresholds of 500 parts per million (ppm) for all components except compressors (see 33-15-12, 40 CFR 60, Subpart GGGa for details). Loadout facilities to trucks must have vapor emission control system (i.e. VRU) will be installed. Gas disposal must be routed to flare gas recovery, flare, or equally effective control device. All rotating pumps and compressors handling VOC must be equipped and operated with properly maintained seals designed for their specific product service and operating condition.

The refinery will comply with the requirements of this section through compliance with 40 CFR 60, Subpart QQQ, by implementation of the ELDAR program and through the use of submerged filling, pressure tanks, and operation of vapor recovery systems on

applicable tankage and the loadout facilities.

H. Chapter 33-15-08 - Control of Air Pollution from Vehicles and Other Internal Combustion Engines

This chapter restricts the operation of internal combustion engines which emit from any source unreasonable and excessive smoke, obnoxious or noxious gas, fumes or vapor. The emergency generators and fire pump engines are subject to this chapter's requirements.

The provisions of this chapter allow no person to operate, or cause to be operated, any internal combustion engine which emits from any source any unreasonable and excessive smoke, obnoxious or noxious gases, fumes or vapor. The emergency fire pump engines and emergency generators will be new, state-of-the-art-units which will not be expected to emit any unreasonable and excessive smoke, obnoxious or noxious gases, fumes, or vapor.

I. Chapter 33-15-09 - [Repealed]

J. Chapter 33-15-10 - Control of Pesticides

The facility will use contracted services for pesticide application if needed.

K. Chapter 33-15-11 - Prevention of Air Pollution Emergency Episodes

When an air pollution emergency episode is declared by the Department, the facility shall comply with the requirements in Chapter 33-15-11 of the North Dakota Air Pollution Control (NDAPC) rules. The permittee shall prepare an air pollution abatement strategy in accordance with Chapter 33-15-11-04.

L. Chapter 33-15-12 - Standards of Performance for New Stationary Sources (40 CFR 60)

This chapter adopts most the Standards of Performance for New Stationary Sources (NSPS) under 40 CFR Part 60. The Davis Refinery is subject to the following subparts under 40 CFR Part 60 which have been adopted by North Dakota:

Subpart A – General Provisions

Subpart A contains general requirements for plan reviews, notification, recordkeeping, performance tests, reporting, monitoring and general control device requirements.

The facility will comply with the general provisions of Subpart A through submission of timely notifications, performance testing, reporting, and following

the general control device and work practice requirements under Subpart A. In addition, any changes to the facility after it is built will be evaluated with respect to this subpart as well as others.

Subpart Dc – Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units

This subpart is applicable to steam generating units that have a heat input capacity of 10-100 million Btu/hr and commence construction after June 9, 1989. The emission units subject to NSPS Dc include the Medium Pressure (EU 8A-8D) and High Pressure (EU 8E-8G) Steam Boilers. The High Pressure Steam Boilers also meet the applicability requirements of NSPS Ja since these units will fire refinery fuel gas (RFG). Other fuel burning equipment at the facility is not subject to NSPS Dc since the equipment does not meet the definition of a steam generating unit.

The Medium Pressure Steam Boilers will comply with NSPS Dc by exclusively firing pipeline quality natural gas and maintaining fuel records. The High Pressure Steam Boilers will comply with NSPS Dc by maintaining compliance with NSPS Ja, as described in the following section.

Subpart Ja – Standards of Performance for Petroleum Refineries for Which Construction, Reconstruction, or Modification Commenced after May 14, 2007

This subpart applies to fluid catalytic cracking units, fluid coking units, delayed coking units, fuel gas combustion devices (FGCD) (including process heaters), flares, and sulfur recovery plants in petroleum refineries. No fluid catalytic cracking units, fluid coking units, or delayed coking units will be installed at the Davis Refinery.

NSPS Ja defines "petroleum refinery" as "any facility engaged in producing gasoline, kerosene, distillate fuel oils, residual fuel oils, lubricants, asphalt (bitumen) or other products through distillation of petroleum or through redistillation, cracking, or reforming of unfinished petroleum derivatives." The facility produces products through distillation of petroleum, and is therefore classified as a petroleum refinery subject to NSPS Ja.

The units subject to regulation under this subpart include the refinery process heaters (EUs 1A, 1B, 2A, 3A, 3B, 3C, 4A, 4B, 4C, 4D, 5A, 5B, 6A, and 6B), High Pressure Steam Boilers (EUs 8E, 8F, and 8G), the sulfur recovery unit (EU 7) and the refinery flare system (EU 10, 10A, 10B, and 10C).

NSPS Ja establishes emission limits for fuel gas combustion devices. Fuel gas is is defined as "any gas which is generated at a petroleum refinery and which is combusted".

Each fuel gas combustion device is subject to H_2S limits in the fuel gas burned. Per NSPS Ja, the fuel gas may not contain H_2S in excess of 162 ppmv on a 3-hour rolling average basis and H_2S in excess of 60 ppmv on a 365-day rolling average basis. The owner/operator is required to monitor the H_2S content of the fuel gas to demonstrate compliance with the limits.

The facility will install a continuous monitor system (CMS) on the RFG system header exiting the SRU that is common to all the FGCD to comply with §60.107a(a)(2). Additionally, due to facility-wide emission restrictions, the facility has a fuel gas H_2S limit of 15 ppmv determined daily on a 30-day rolling average.

Each natural draft process heater with a rated capacity of greater than 40 million Btu (MMBtu)/hr is subject to either a NO_X emission limit of:

a) 40 ppmv (dry basis, corrected to 0% excess air) determined daily on a 30-day rolling average basis.; or

b) 0.040 lb/MMBtu higher heating value basis determined daily on a 30-day rolling average basis.

This NO_X emission limit is applicable to EUs 1A, 1B, 2A, 4A, 4B, 4C, and 6B; and under NSPS Ja (§60.107a(c)) requires the owner/operator to install a continuous emissions monitor system (CEMS) to measure the NO_X emissions. Due to facility-wide emission restrictions, the facility has accepted a NO_X limit of 0.0063 lb/MMbtu determined daily on a 30-day rolling average basis (equivalent to no greater than 6 ppmvd, corrected to 0% excess O_2) on EUs 1A, 1B, 2A, 4A, 4B, 4C, 6A, and 6B and will install NO_X CEMS to meet the requirements. In addition, although not subject to the NSPS Ja NO_X limits, the Davis Refinery has accepted NO_X limits of 0.0300 lb/MMbtu determined daily on a 30-day rolling average basis (equivalent to no greater than 29 ppmvd, corrected to 0% excess O_2) for EUs 3A, 3B, 3C, 4D, 5A, 5B, 8A, 8B, 8C, 8D, 8E, 8F, and 8G to meet facility-wide emission restrictions.

The facility will operate a sulfur recovery plant with a capacity of less than 20 long tons per day with a reduction control system followed by incineration. Thermal Oxidizer (EU 7A) is the incinerator following the SRU and is the only point source of emissions from the sulfur recovery plant. NSPS Ja establishes a limit on emissions from the sulfur recovery plant of 2,500 ppm by volume of SO_2 (dry basis) at zero percent excess air, on a 12-hour rolling average basis. The facility is required to monitor SO_2 emissions to demonstrate compliance with the limits. To comply with the facility wide SO_2 emissions restriction, EU 7A emissions will typically be between 1-2 ppmv SO_2.

NSPS Ja requires that the owner/operator develop and implement a flare management plan for all flares. Flares that are affected facilities under NSPS Ja at the refinery are EU 10, 10A, 10B, and 10C. The flares may not burn any fuel gas that contains H_2S in excess of 162 ppmv determined hourly on a 3-hour rolling average basis. The flare pilots will burn pipeline quality natural gas to demonstrate compliance with this limit. Combustion of process upset gases or fuel gas released to the flare as the result of relief valve leakage or other emergency malfunctions is exempt from this limit. The facility is required to monitor the flow of gases released to the flares, following the requirements of §60.107a(f).

Hydrocarbon (HC) flare (EU 10) will be the first flare downstream of the flare gas recovery system. HC Secondary Flare #1 (EU 10B), HC Secondary Flare #2 (EU 10C) will be secondary flares fitted with water seals downstream of EU 10. Based on the intended operation of the HC flare system (EU-10, EU-10B & C) and the facility vapor recovery system, the HC flare system qualifies for the provisions of §60.107a(b) (exemption from H_2S monitoring requirements for low-sulfur fuel gas streams). Gas streams passing on to the cascaded flares will also be inherently low in sulfur content, only minor amounts of H_2S will be relieved by the pressure relief valves (PRVs) during routine operations at any time. Because it qualifies for §60.107a(b) then it also qualifies for the root cause analysis requirements exemption of (e) and (f) and is only required to monitor in accordance with (g).

In cases of start-up, shutdown or malfunction (SSM) the acid gas (high H_2S) streams will bypass the VRU and be routed directly to the Acid Gas Flare (EU 10A). Since this flare will combust gas subject to sulfur limits, the facility shall comply with the sulfur monitoring requirements in §60.107a(e) for assessing the root cause analysis threshold for EU 10A.

The flare system is a safety and emissions control device. Unlike a typical emissions unit, the PTE is based on normal process unit operations that vent gas to the flare rather than using the hydraulic capacity of the flare itself or any of the alternative baseline flow scenarios. The facility will report the actual flare system emissions during all modes of operation in its routine reporting submittals, such as the annual emissions inventory and monthly compliance tracking calculations.

Lastly, each FGCD, flare, and sulfur recovery plant shall conduct a root cause analysis and corrective action analysis for each of the conditions specified in §60.103a(c)(1) through (c)(3) (unless indicated differently above). The root cause analysis and corrective action analysis must be completed by the schedule provided in §60.103a(d) and shall implement the corrective actions in accordance with §60.103a(e).

Subpart Kb – Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction,

or Modification Commenced After July 23, 1984

This subpart applies to each storage tank with a capacity greater than 75 cubic meters (approximately 19,800 gallons or 470 barrels) used to store volatile organic liquids, except that the subpart does not apply to storage tanks with a capacity greater than or equal to 151 cubic meters (approximately 39,890 gallons or 950 barrels) storing a liquid with a maximum true vapor pressure less than 3.5 kilopascals (kPa) or with a capacity greater than or equal to 75 cubic meters but less than 151 cubic meters storing a liquid with a maximum true vapor pressure less than 15.0 kPa. Based on these criteria, tanks: 301, 302, 305, 306, 307, 308, 309, 311, 312, 327, 328, 331, and 332 are subject to NSPS Kb.

Petroleum refinery storage vessels are potentially subject to tank requirements under the NSPS, NESHAP, and/or MACT standards, depending on the size, material stored, and year constructed. By rule, the facility will have storage vessels subject to NSPS Kb and MACT 6B. As allowed[1,2] for IFR tanks, the facility has elected to comply with the more stringent requirements of 40 CFR 63, Subpart WW – National Emission Standards for Storage Vessels – Control Level 2 (MACT WW) and shall comply with all applicable design, recordkeeping, and reporting requirements.

Demonstrating compliance with MACT WW will also qualify as demonstrating compliance with NSPS Kb. Implementing this level of tanks program is expected to reduce VOC emissions from the storage tanks at the facility.

Subpart GGGa – Standards of Performance for Equipment Leaks of VOC in Petroleum Refineries for Which Construction, Reconstruction, or Modification Commences after November 7, 2006

NSPS GGGa applies to equipment (valves, pumps, pressure relief devices, etc.) in VOC service at petroleum refineries. Equipment at the facility will be subject to this subpart. The subpart establishes standards for equipment as well as leak detection and repair requirements and references requirements in 40 CFR 60, Subpart VVa – Standards of Performance for Equipment Leaks of VOC in the Synthetic Organic Chemicals Manufacturing Industry for Which Construction, Reconstruction or Modification Commenced After November 7, 2006 for

1 40 CFR 63, Subpart BBBBBB. Table 1, 2(d) "Equip and operate each internal floating roof gasoline storage tank according to the applicable requirements in §63.1063(a)(1) and (b), except for the secondary seal requirements under §63.1063(a)(1)(i)(C) and (D)"

2 40 CFR 63, Subpart CC. §63.640(n) "Overlap of this subpart with other regulations for storage vessels." allows sources subject to both NSPS Kb and MACT CC to comply with only one of the subparts. Subsequently, §63.660 states "the owner or operator of a Group 1 storage vessel that is part of a new or existing source shall comply with the requirements in subpart WW of this part according to the requirements in paragraphs (a) through (i) of this section"

compliance.

NSPS GGGa establishes standards as well as monitoring and repair requirements that the owner/operator will be required to comply with to minimize emissions from equipment leaks. Based on these criteria, the equipment in VOC service at EUs 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 11A are subject to NSPS GGGa.

Generally, equipment leaks at petroleum refineries are potentially subject to requirements under the NSPS, NESHAP, and/or MACT standards, depending on year constructed and materials processed at the facility. These regulations include, but are not limited to: NSPS VV, NSPS VVa, NSPS GGG, NSPS GGGa, NESHAP J, and NSHAP V. As allowed under NSPS VVa[3], the facility has elected to comply with the requirements of 40 CFR 63, Subpart H – National Emission Standards for Organic Hazardous Air Pollutants for Equipment Leaks (MACT H). Subsequently under MACT H (§63.160(c)), compliance with MACT H shall deem compliance with 40 CFR 61, Subparts J and V.

In addition to the MACT H compliance requirements, the facility shall meet VOC emissions reductions equivalent to the Texas Commission on Environmental Quality (TCEQ) 28LAER program[4]. The facility is required to implement the leak detection and repair (LDAR) program for equipment in VOC service with a screening rate of 500 ppmv, expect for compressors (10,000 ppmv). The TCEQ 28LAER program and leak threshold table are summarized as follows:

Equipment/Service		**TCEQ 28LAER Control Efficiency**	**Leak Threshold (ppmv)**
Valves	Gas/Vapor	97%	500
	Light Liquid	97%	500
	Heavy Liquid	0%	500
Pumps	Light Liquid	85%	500
	Heavy Liquid	85%	500
Flanges/ Connectors	Gas/Vapor	97%	500
	Light Liquid	97%	500
	Heavy Liquid	30%	500

3 40 CFR 60, Subpart VVa. §60.480a(e)(2)(i) "Owners or operators may choose to comply with the provisions of 40 CFR part 63, subpart H, to satisfy the requirements of §60.482-1a through §60.487a for an affected facility. When choosing to comply with 40 CFR Part 63, Subpart H, the requirements of §60.485a(d), (e), and (f), and §60.486a(i) and (j) still apply.

4 Attachment 4 <https://www.tceq.texas.gov/permitting/air/guidance/newsourcereview/fugitives/nsr_fac_eqfug.html>

Compressors	85%	10,000
Relief Valves (Gas/Vapor)	97%	500
Sampling Connections	97%	500

To further improve the efficiency of the LDAR program at the facility, the facility will use Optical Gas Imagining (OGI) along with Method 21 (40 CFR 60, Appendix A-7, Method 21 – Determination of volatile organic compound leaks) analyzers at least every 60 days.

Demonstrating compliance with the proposed enhanced LDAR (ELDAR) program will also qualify as demonstrating compliance with NSPS GGGa. Implementing this strict of an LDAR program is expected to greatly reduce VOC emissions from the equipment in VOC service at the facility.

Subpart NNN – Standards of Performance for Volatile Organic Compound (VOC) Emissions from Synthetic Organic Chemical Manufacturing Industry (SOCMI) Distillation Operations

NSPS NNN applies to process units at the facility associated with the generation of LPG, light naphtha, and gasoline-range compounds as a product, co-product, by-product, or intermediate. Units subject to the NSPS NNN include: ADUs (EU 1), VDU (EU 2), NHT (EU 3), CRU (EU 4), Benzene Saturation Unit, and HYK (EU 6).

The facility will comply with NSPS NNN by installation of a VRU to capture all flows discharged through the vent streams of the affected units, except those resulting from SSM events. In the event gas flow rates exceed VRU capacity, the facility will combust the excess overhead gas flow in a flare to comply with §60.662.

Subpart QQQ – Standards of Performance for VOC Emissions from Petroleum Refinery Wastewater Systems

NSPS QQQ applies to wastewater systems at petroleum refineries. The facilities individual drain system, oily water sewer system, and closed vent system will be subject to the design, operations, and inspections requirements under §60.692.

The facility will comply with NSPS QQQ by designing, installing, and operating a wastewater system that will meet the standards in accordance with applicable sections of NSPS QQQ.

Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

The emergency diesel engine generators (EUs 14A-C) and the diesel fire pump engines (EUs 15A-C) are subject to the requirements of NSPS IIII. NSPS IIII establishes emission limits for NO_X+NMHC (non-methane hydrocarbons) and PM emissions. The owner/operator shall achieve compliance with the regulation by purchasing engines certified to meet the emission standards of the regulation.

M. Chapter 33-15-13 - Emission Standards for Hazardous Air Pollutants

This chapter adopts most the National Emission Standards for Hazardous Air Pollutants (NESHAP) under 40 CFR Part 61. The Davis Refinery is subject to the following subparts under 40 CFR Part 61 which have been adopted by North Dakota:

Subpart J – National Emission Standard for Equipment Leaks (Fugitive Emission Sources) of Benzene

Compliance with this subpart achieved through compliance with the ELDAR program.

Subpart V – National Emission Standard for Equipment Leaks (Fugitive Emission Sources)

Compliance with this subpart achieved through compliance with the ELDAR program.

Subpart FF—National Emission Standard for Benzene Waste Operations (BWON)

The oily water treatment system at the facility and individual drain lines that convey process waste water to the oily water treatment system are subject to the BWON provisions. The provisions of this subpart apply to individual drain systems used to convey process wastewater from a process unit, product storage tank, or waste management unit to a waste management unit. Individual drain systems include all process drains and common junction boxes, together with their associated sewer lines and other junction boxes, down to the receiving wastewater treatment system.

Waste that is contained in a segregated stormwater sewer system and any gaseous stream from a waste management unit, treatment process, or wastewater treatment system routed to a fuel gas system, are exempt from compliance with the provisions of this subpart.

N. Chapter 33-15-14 - Designated Air Contaminant Sources, Permit to Construct, Minor Source Permit to Operate, Title V Permit to Operate

This chapter requires the facility to obtain a Permit to Construct and a Permit to Operate.

The facility has met all requirements necessary to obtain a Permit to Construct. Once the Davis Refinery completes construction and meets the permit to construct requirements, a facility inspection will be performed by the Department. Upon a satisfactory inspection and performance testing, the Davis Refinery will be issued a Permit to Operate.

O. Chapter 33-15-15 - Prevention of Significant Deterioration of Air Quality

This chapter adopts the federal provisions of the prevention of significant deterioration of air quality (PSD) program. A facility is subject to PSD review if it is classified as a "major stationary source" under Chapter 33-15-15. The Davis Refinery will be subject to federally enforceable emission limitations via a synthetic minor permit to construct to remain below "major source thresholds" and therefore is not subject to PSD review under this chapter.

P. Chapter 33-15-16 - Restriction of Odorous Air Contaminants

This chapter restricts the discharge of objectionable odorous air contaminants which measures seven odor concentration units or greater outside the property boundary. Based on Department experience with sources having similar emissions, the facility is expected to comply with this chapter.

Q. Chapter 33-15-17 - Restriction of Fugitive Emissions

This chapter restricts fugitive emissions from the facility; specific to particulate matter emissions (fugitive VOCs are regulated under 33-15-07 and under the facility specific ELDAR program).

This chapter restricts fugitive emissions from any source by requiring the facility to take reasonable precautions in preventing such emissions. The facility will be required to take reasonable precautions to prevent fugitive emissions.

R. Chapter 33-15-18 - Stack Heights

This chapter restricts the use of stack heights above good engineering practices (GEP). This chapter also restricts the use of dispersion techniques to affect the concentration of a pollutant in the ambient air.

The stacks at the Davis Refinery will not exceed GEP and will not use dispersion techniques to affect the pollutant concentration in the ambient air.

The stack heights at the Davis Refinery are listed in the following table:

Emission Unit Description	**Emission Point (EP)**	**Stack Height (Feet)**
ADU Feed Heater #1	1A	128

ADU Feed Heater #2	1B	128
VDU Feed Heater	2A	125
NHT Feed Heater	3A	91
NHT Stabilizer Reboiler	3B	91
NHT Splitter Reboiler	3C	105
CRU Reactor #1/2/3 Heater	4	130
CRU Stabilizer Reboiler	4D	42
CRU Regenerator Vent	4E	40
DHT Feed Heater	5A	96
DHT Splitter Reboiler	5B	91
HYK Reactor Heater	6A	100
HYK Fractionator Heater	6B	100
Thermal Oxidizer	7A	60
Medium Pressure Steam Boiler #1/2/3/4	8	100
High Pressure Steam Boiler #1	8E	100
High Pressure Steam Boiler #2	8F	100
High Pressure Steam Boiler #3	8G	100
Enclosed hydrocarbon (HC) operating flare	10	50
Acid gas flare	10A	150
HC secondary flare #1	10B	150
HC secondary flare #2	10C	150

S. Chapter 33-15-19 - Visibility Protection

This chapter applies to major stationary sources as defined in section 33-15-15-01.

The facility will not be a major stationary source and therefore is not subject to the requirements of this chapter. Given the minor source levels of the visibility impairing air pollutants, such as NO_X, SO_2, and $PM_{2.5}$, it is expected that the Davis Refinery will not adversely contribute to visibility impairment within the three units of the Theodore Roosevelt National Park (nearest federal Class I areas).

T. Chapter 33-15-20 - Control of Emissions from Oil and Gas Well Production Facilities

The facility is not an oil or gas well facility and is therefore not subject to the requirements of this chapter.

U. Chapter 33-15-21 - Acid Rain Program

This chapter adopts the acid rain provisions of the Clean Air Act specified under 40 CFR Parts 72-78. The Davis Refinery is not subject to the acid rain provision as they are not an electric utility.

V. Chapter 33-15-22 - Emissions Standards for Hazardous Air Pollutants for Source

Categories

This chapter adopts the 40 CFR Part 63 regulations, also known as the Maximum Achievable Control Technology (MACT) standards, which regulates hazardous air pollutants (HAPs) from regulated source categories. Typically, these standards apply to major sources of air pollution that are a regulated source category. In addition to the major source requirements, some of the regulations have "area source" standards (for non-major sources). Some of the area source standards have not been adopted by the Department and compliance will be determined by the United States Environmental Protection Agency (USEPA) (i.e. 40 CFR 63, Subpart ZZZZ area source provisions have not been adopted by the Department).

The facility's potential HAP emissions are less than 10 tons/year of any single HAP and are less than 25 tons/year of any combination of HAPs, so the facility is an area (minor) source of HAPs. As shown in the Allowable/Expected Emissions Section, total potential HAPs from the facility are approximately 6.2 tons/year, and the greatest single potential HAP is Hexane at 2.4 tons/year.

Although not applicable to the Davis Refinery, the subparts applicable to major source petroleum refineries are identified below. It should be noted that, while the major source MACT standard requirements do not apply to the Davis Refinery, the facility will comply with most of these standards via compliance with strict emission limits and environmental programs (i.e. the ELDAR program).

40 CFR 63, Subpart H – National Emission Standards for Organic Hazardous Air Pollutants for Equipment Leaks

Although not subject to by rule, the facility has elected to the comply with the equipment leak provisions of this subpart for equipment in VOC service subject to NSPS GGGa. See NSPS GGGa section for compliance details. In addition to the general MACT H compliance requirements, the facility is taking a lower leak threshold for equipment in VOC service (as described in NSPS GGGa section).

40 CFR 63, Subpart CC – National Emission Standards for Hazardous Air Pollutants from Petroleum Refineries

MACT CC is not applicable to the Davis Refinery; however, many of the regulatory requirements of this rule will be met through implementation of the various environmental programs and compliance obligations stated in this AQEA.

MACT CC is applicable to the following units located at a major source of HAPs. Listed next to the unit is the program(s) which the Davis Refinery uses that would satisfy the requirements of the Subpart.

- Fugitives Emissions – ELDAR
- Heat Exchange Systems – ELDAR
- Process Vents – ELDAR
- Storage Tanks – MACT WW and ELDAR
- Transfer Operations – MACT 6B and ELDAR
- Wastewater Streams (Control Devices) – NSPS QQQ and NESHAP FF
- Fenceline Monitoring (Benzene) – implementing alternative benzene fenceline monitoring program to the Department's satisfaction

40 CFR 63, Subpart WW – National Emission Standards for Storage Vessels (Tanks) – Control Level 2

Although not subject to by rule, the facility has elected to the comply with the storage vessel provisions of this subpart for tanks subject to NSPS Kb and/or MACT BBBBBB (6B). See NSPS Kb section for compliance details.

40 CFR 63, Subpart UUU – National Emission Standards for Hazardous Air Pollutants for Petroleum Refineries: Catalytic Cracking Units, Catalytic Reforming Units, and Sulfur Recovery Units

MACT UUU is not applicable to the Davis Refinery; however, many of the regulatory requirements of this rule will be met through implementation of the various environmental programs and compliance obligations stated in this AQEA.

MACT UUU is applicable to the following units located at a major source of HAPs. Listed next to the unit is the program which the facility uses that would satisfy the requirements of the Subpart.

- Catalytic Cracking Units – none at facility
- Catalytic Reforming Units – operate at all times according to your operation, maintenance, and monitoring plan regarding minimum catalyst purging conditions that must be met prior to allowing uncontrolled purge releases.
- Sulfur Recovery Units – NSPS Ja
- Bypass Lines – none applicable

40 CFR 63, Subpart ZZZZ – National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines

The engines to be installed are considered new engines under this subpart. Compliance with this subpart is attained by complying with the requirements of 40 CFR 60, Subpart IIII.

Note: the Department has not adopted the area source provisions of this subpart. USEPA will determined compliance with this subpart. All required documentation must be submitted to EPA Region 8 at the following address:

U.S. EPA Region 8
1595 Wynkoop Street
Mail Code 8ENF – AT
Denver, CO 80202-1129

40 CFR 63, Subpart BBBBBB – National Emission Standards for Hazardous Air Pollutants for Gasoline Distribution Bulk Terminals, Bulk Plants, and Pipeline Facilities

MACT 6B is applicable to area source bulk gasoline terminals, pipeline breakout stations, pipeline pumping stations, and bulk gasoline plants. The facility is considered a gasoline bulk terminal subject to the provisions of the subpart for the gasoline storage tanks and the tank truck loadout provisions. The facility will: load gasoline only in vapor tight cargo tanks that have been tested with the frequency and by the methods specified in 40 CFR 63.425 to assure vapor tightness, maintain records of product throughputs, and implement the ELDAR program at the loading rack.

40 CFR 63, Subpart JJJJJJ – National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers at Area Sources

The boilers at the facility are fired on gas (either refinery gas or natural gas), the requirements of Subpart JJJJJJ are not applicable.

W. Chapter 33-15-23 - Fees

This chapter requires a filing fee of $325 for permit to construct applications, plus any additional fees based on actual processing costs. The additional fees based on processing costs will be assessed upon issuance of the draft permit to construct. An annual operating permit fee is also applicable, once an operating permit is issued to the facility.

The applicant has paid the $325 filing fee and will be required to pay the additional fees associated with the permit processing.

X. Chapter 33-15-24 - Standards for Lead-Based Paint Activities

The Davis Refinery will not perform any lead-based painting and is therefore not subject to this chapter.

Y. Chapter 33-15-25 - Regional Haze Requirements

This chapter is specific to existing stationary facilities and the installation of best

available retrofit technology (BART). The Davis Refinery is a new source and therefore not subject to the requirements of this chapter.

Summary:

A complete review of the proposed project indicates that the facility is expected to comply with the applicable federal and state air pollution rules and regulations. Therefore, Meridian Energy Group, Inc. has met all the requirements for obtaining a Permit to Construct and a draft Permit to Construct will be made available for public comment.

Given the level of public interest, a 30-day public comment period (PCP) and concurrent 30-day EPA review period is required prior to permit issuance. In addition, the Department will hold a public meeting followed by a public hearing in Dickinson, North Dakota for interested parties. Upon completion of the PCP, the Department will address all comments applicable to the state and federal air quality rules and regulations and make a final determination regarding the issuance of a Permit to Construct for the Davis Refinery.

Date of Analysis: PUBLIC COMMENT DRAFT – 10/26/2017

Analysis By:

David Stroh
Environmental Engineer
Division of Air Quality

DES:
Attach: Draft Permit to Construct (Attachment 1)
Air Quality Impacts Analysis (Attachment 2)
Plot Plan and Process Flow Diagram (Attachment 3)
TCEQ 28LAER (Attachment 4)
October 6, 2014 Department Memorandum (Attachment 5)